THIRD EDITION

ROUTLEDGE

# THE ESSENTIALS OF INSTRUCTIONAL DESIGN

## Connecting Fundamental Principles with Process and Practice

ABBIE H. BROWN ▪ TIMOTHY D. GREEN

# The Essentials of Instructional Design

*The Essentials of Instructional Design, Third Edition* introduces the essential elements of instructional design (ID) to students who are new to ID. The key procedures within the ID process—learner analysis, task analysis, needs analysis, developing goals and objectives, organizing instruction, developing instructional activities, assessing learner achievement, and evaluating the success of the instructional design—are covered in complete chapters that describe and provide examples of how the procedure is accomplished using the best-known instructional design models.

Unlike most other ID books, *The Essentials of Instructional Design* provides an overview of the principles and practice of ID without placing emphasis on any one ID model. Offering the voices of instructional designers from a number of professional settings and providing real-life examples from across sectors, students learn how professional organizations put the various ID processes into practice. This introductory textbook provides students with the information they need to make informed decisions as they design and develop instruction, offering them a variety of possible approaches for each step in the ID process and clearly explaining the strengths and challenges associated with each approach.

**Abbie H. Brown** is Professor of Instructional Technology at East Carolina University, USA. He served as Editor-in-Chief of the AECT journal *TechTrends*, and is a recipient of the University of North Carolina Board of Governors Award for Excellence in Teaching.

**Timothy D. Green** is Professor of Educational Technology at California State University, Fullerton, USA, and previously served as the Director of Distance Education.

This page intentionally left blank

# The Essentials of Instructional Design

## Connecting Fundamental Principles with Process and Practice

Third Edition

Abbie H. Brown
Timothy D. Green

Routledge
Taylor & Francis Group
NEW YORK AND LONDON

Third edition published 2016
by Routledge
711 Third Avenue, New York, NY 10017

and by Routledge
2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

*Routledge is an imprint of the Taylor & Francis Group, an informa business*



First edition published 2006 by Pearson/Merrill Prentice Hall
Second edition published 2010 by Pearson

*Library of Congress Cataloging in Publication Data*
Brown, Abbie.
The essentials of instructional design : connecting fundamental principles with process and practice / by Abbie H. Brown, Ph.D., East Carolina University Timothy D. Green, Ph.D., California State University, Fullerton. — Third edition.
pages cm
Includes bibliographical references and index.
1. Instructional systems—Design. I. Green, Timothy D., 1968- II. Title.
LB1028.38.B76 2015
371.3—dc23
2015003334

ISBN: 978-1-138-79705-5 (hbk)
ISBN: 978-1-138-79707-9 (pbk)
ISBN: 978-1-315-75743-8 (ebk)

Typeset in Sabon
by Swales & Willis Ltd, Exeter, Devon, UK

To PSH.—AHB
To my family.—T

# Contents

# Preface

The intention of this book is to provide a foundational overview of instructional design activities; to explain the essential principles of instructional design; to describe the processes used to put these principles into practice, and to offer examples of their practical application in a manner that transcends any single ID model or approach.

The third edition provides more details and updated information about the instructional design process:

- Each chapter that addresses one of the instructional design processes begins with brief cases that illustrate the challenges instructional designers face with regard to that specific process. Each case is revisited at the chapter's midpoint and end, illustrating the process in action.
- Chapters have been reorganized into five parts: Before you begin designing instruction; Examining the situation—needs, task, and learner analysis; Creating instruction—planning, designing, and implementing the intervention; Evaluation—determining the effect of the intervention; and Media production—managing the media development process. The organization aligns the chapters with the most common presentation of the content in college courses.

## This Is a Book for Beginners

This book is not intended to replace or compete with such texts as Dick, Carey, and Carey's *The systematic design of instruction*; Smith and Ragan's *Instructional design*; or Morrison, Ross, and Kemp's *Designing effective instruction*. These texts and others like them form the core of any instructional design professional's library. Each provides valuable information about a single model or a specific approach to instructional design (ID) that is worth detailed study by students at the intermediate and advanced levels.

This book is designed to introduce the essential elements of instructional design to students who are new to ID, providing an overview of the fundamental principles, processes, and practices that currently shape and define the field. In the chapters that describe the essential elements of instructional design, we begin by articulating the principle (e.g., *task analysis*); then describe, compare, and contrast the processes of applying the principle established by leaders in the field; finally, we offer practical examples of how to apply the principle.

No matter which established model one refers to, there are generally three phases to the ID process: examination of the situation (needs, task, and learner analysis); creating instruction (planning, creating, and implementing the intervention); and evaluating the effect of the instruction. Once an individual understands these phases, he or she is ready to study and experiment with various methods of putting them into practice. This book explains the component parts of each of these phases, making reference to the most popular models and approaches and describing, comparing, and contrasting the strengths of each approach. This book also includes examples and recommendations for practical application.

## The Five Parts of This Book

Although the ID process can be articulated as having three major phases, this book is divided into a total of five parts. The first part we call, "Before You Begin Designing Instruction"; this part contains information that is necessary for every ID professional but is not a traditional component of the ID process. Part I includes chapters that review the discipline of instructional design and what is known about thinking and learning. Parts II, III, and IV are the generally agreed-upon, principal phases of ID, examining the situation, creating instruction, and evaluating the instruction's effect.

Part V deals with production issues. In this part we have provided a chapter on *production management* and a chapter on *visual design*—we have included these at the request of a great many of our colleagues. The chapter on production management deals with practical issues of producing instructional media. The chapter on visual design explains basic visual design principles and methods of creating effective and pleasing visual displays. Although this may not always be part of every instructional designer's job, it is often a part of an instructional design student's experience. The production management chapter also contains information on communication and conflict resolution that has proven helpful to students working on ID projects.

## Professionals in Practice

To provide even greater breadth to this text we asked instructional designers from a number of professional settings to provide descriptions of how their organizations put the various ID principles and processes into practice. These descriptions, along with some of our own experiences as instructional designers and teachers, are shared in sections we call *Professionals in Practice*. We hope these reports from the field help students better understand how these processes are applied in business and education settings.

It is our sincere hope that this text will provide students with an introduction to the principles and processes of instructional design without placing undo emphasis on any single ID model, while at the same time offering practical advice on how to design, develop, and evaluate instruction. We hope the practical examples and suggestions we have included will help novice instructional designers understand the issues that surround ID in practice. Furthermore, we hope the descriptions of the processes and the practical examples presented will help emergent instructional designers apply these principles and processes to their own projects.

Abbie Brown and Tim Green

# Acknowledgments

We would like to express our appreciation to everyone at Routledge, with special thanks to Alex Masulis and Daniel Schwartz for their help and guidance.

We would also like to thank our colleagues who contributed to the *Professionals in Practice* sections, Kara Andrew, Kursat Cagiltay, Lisa Hansen, Ken Hubbell, Erik Novak, and Jody Peerless, for sharing their instructional design experience, knowledge, and insight.

This page intentionally left blank

# Part I

# Before You Begin Designing Instruction

Chapters 1 and 2 provide background information that you will find useful as you begin your study of instructional design. Chapter 1 is an overview of the history, traditions, and current state of the *discipline of instructional design*.

Chapter 2 describes *how people think and learn*. This chapter introduces and reviews cognition and the basic cognitive functions as well as the most popular description of what learning is and how it occurs.

Chapter 1

# The Discipline of Instructional Design

Source: Shutterstock 67247662.

*People have been instructing each other since people have existed. Showing an infant how to speak; explaining to an apprentice how an axe head is forged; guiding a daughter's hands as she attempts to make a clay pot—humans have been teaching each other for a long time.*

*Instruction can be a casual event. It can be as simple as answering a question such as, "How did you do that?" Instruction can also be carefully planned. It can encompass a course of study that concludes with students receiving a diploma or certificate marking the achievement. It is the history and current state of instruction brought about through careful planning—the discipline of instructional design—that we will examine in this chapter.*

## Guiding Questions

- What is an instructional designer?
- How did the discipline of instructional design develop?
- What is an instructional design/development model?
- How has general systems theory affected instructional design?
- How does the historical and philosophical postmodern approach affect instructional design?

## Key Terms

| | |
|---|---|
| ADDIE model | (page 7) |
| behavioristic | (page 14) |
| educational psychology | (page 5) |
| general systems theory | (page 4) |
| positivistic | (page 17) |
| postmodernism | (page 16) |
| rapid prototyping | (page 18) |

## Chapter Overview

Taking a logical and structured approach to the process of developing, delivering, and evaluating instruction and instructional materials has been popular among scholars and practitioners for almost a century. A number of models have been developed to help explain the processes of instruction as well as the process of designing and developing materials for instruction. This chapter provides an overview of instructional design from its beginnings in the late 19th century, through its blossoming in conjunction with the development of **general systems theory**, up to a present-day postmodern look at how instructional design (or ID) continues to develop. This chapter also describes the essential processes of instructional design as they are articulated through traditional ID models and examines the potential of nontraditional models, describing rapid prototyping in particular as an innovative ID approach.

### A Historian's View of Instructional Design

No particular event or date marks the beginning of a modern science and technology of instruction. Yet it is clear that at the beginning of the 20th century there occurred a series of related events that together might be interpreted as the beginning of a science of instruction.

William James (1842–1910), for example, in his book *Talks to teachers on psychology*, makes one of the first distinctions between the art and the science of teaching, calling for a scientific approach to instruction. Similarly, also in 1901, John Dewey (1859–1952) interpreted a method of empirical science in educational terms, viewing the classroom as an experimental laboratory. In 1902, Edward Thorndike (1874–1949) offered the first course in educational measurements at Columbia University and became the first to apply the methods of quantitative research to instructional problems. G. Stanley Hall (1846–1924) published his *Adolescence* (1904), a landmark in the scientific study of the child. The French psychologist Alfred Binet (1857–1911) and Théodore Simon, his collaborator, published *A method of measuring the intelligence of young children* (1905). Moreover, a true science of behavior, and especially of learning theory, began to emerge, no longer based primarily on metaphysical or philosophical speculation. This new science and learning theory would eventually be applied to a technology of instruction.

*Paul Saettler,*
The evolution of American educational technology *(1990, p. 53)*

## What Is Instructional Design?

*"The purpose of any design activity is to devise optimal means to achieve desired ends."*
—Charles Reigeluth, 1983

The ritual dance around the fire at the front of the cave depicting the hunt and kill of a large animal may be one of mankind's earliest forms of designed instruction. The hunters of the group had to find ways to teach other potential hunters the process of stalking and bringing down a large animal. Creating a dramatic display that describes the procedures for the hunt in a ritualized fashion captures the group's attention and provides them with a stylized presentation of how hunting works. This type of instructional design—based on inspiration and creativity—remained prevalent for millennia. But the *science* of instructional design is relatively new.

Throughout history, a number of individuals gave careful thought to the design of instruction. For example, the scholar Comenius (1592–1671) was among the first to plan for the use of visual aids in teaching. Comenius's *Orbis sensualum pictus* (*The visible world pictured*) was the first illustrated textbook designed for children's use in an instructional setting (Heinich, Molenda, Russell, & Smaldino, 1996). Until the late 1800s, however, there was no organization that gathered this kind of work together, offered like-minded individuals a forum for discussion on the topic, or sought to continue its development.

At the beginning of the 20th century, John Dewey—one of our most influential educators—called for a linking science between what is known about how people learn and the practice of delivering instruction (Dewey, 1900). At the time, this was a radical thought. Before the mid-1800s, there was no educational science with which to link.

There had been no organization devoted to the study of how people learn or how to study methods of delivering instruction. Although there had been scattered attempts to improve instruction throughout history, no specific discipline had emerged to guide these efforts. Education-oriented organizations existed to protect and direct the curriculum and content of the instruction, but very little attention was paid to how instruction might be made more effective. The psychology of education—how the learner learned—was a school of thought in search of an organizing body. With the formation of the American Psychological Association in 1892, the discipline of **educational psychology** began.

In the late 1800s and early 1900s, education was still very much the province of those with religious backgrounds and training (Berliner, 1993). It is important to keep in mind that teachers were originally members of the clergy and that, prior to World War I, one of the main purposes of education in the United States was to ensure that people could read passages from the Bible. It was not easy to convince those who believed education to be a moral and philosophical endeavor that scientific methods might be employed to improve educational processes. With the establishment of the discipline of educational psychology, however, educators interested in improving instructional practice through scientific means found both a home organization and like-minded fellows to report to and hear from.

With the formation of the land-grant universities in the late 1800s (each state was entitled by the federal government to form its own university within the state's borders) and the subsequent need to determine what constituted college readiness on the part of an individual, educational psychologists were called on to develop valid and reliable tests and measures of academic achievement. For example, the Scholastic Achievement Test (or SAT, now known as the Scholastic Aptitude Test) was first offered in 1901 and is to some extent an indicator of a trend toward the scientific testing of the learner to determine the appropriate next course of action in his or her education.

By 1915, the application of scientific methods to the solution of educational problems had won out among the leaders in American education, setting the stage for the development of Dewey's linking science, which scholars such as Snellbecker (1974) suggest is the discipline of instructional design. Educators began to develop an experimental view of instruction. Along with testing students to see what they knew, the newly organized discipline of educational psychology devised tests for the purpose of discovering whether the instruction worked. The traditional approach had been for an educator to focus completely on the information that should be included in the lesson; instructional design demanded that the educator add to that some consideration for how the information was to be organized and presented based on what is known about the learners and their abilities.

As the century progressed and more scholars focused their attention on the science of designing instruction, educational psychology blossomed into university departments and international organizations that reported and discussed research in the field. The discipline of instructional design is directly descended from educational psychology. Although some scholars argue that it is not actually a field of its own but rather a subactivity within educational psychology, instructional design can point to its own university departments and international organizations as indicators that it is now indeed a separate and distinct discipline.

As a linking science, instructional design is a discipline that constantly looks to the findings of other disciplines (e.g., cognitive psychology, communication) to study and improve methods of developing, delivering, and evaluating instruction and instructional practices.

According to Smith and Ragan (2005), instructional design may be currently defined as "the systematic and reflective process of translating principles of learning and instruction into plans for instructional materials, activities, information resources, and evaluation" (p. 4).

The Applied Research Laboratory at Penn State University is attributed with developing a four-part definition of instructional design (University of Michigan, 2003):

> **Instructional Design as a Process:**
> Instructional design is the systematic development of instructional specifications using learning and instructional theory to ensure the quality of instruction. It is the entire process of analysis of learning needs and goals and the development of a delivery system to meet those needs. It includes development of instructional materials and activities; and tryout and evaluation of all instruction and learner activities.
>
> **Instructional Design as a Discipline:**
> Instructional Design is that branch of knowledge concerned with research and theory about instructional strategies and the process for developing and implementing those strategies.
>
> **Instructional Design as a Science:**
> Instructional design is the science of creating detailed specifications for the development, implementation, evaluation, and maintenance of situations that facilitate the learning of both large and small units of subject matter at all levels of complexity.
>
> **Instructional Design as Reality:**
> Instructional design can start at any point in the design process. Often a glimmer of an idea is developed to give the core of an instruction situation. By the time the entire process is done the designer looks back and she or he checks to see that all parts of the "science" have been taken into account. Then the entire process is written up as if it occurred in a systematic fashion.

An instructional designer's job is to create something that enables a person or group of people to learn about a particular topic or develop or improve a set of skills, or to encourage the learner to conduct further study. The "something" created can take many forms: a lecture, a multimedia presentation, the curriculum for a year's study, a piece of computer software, an in-person demonstration, or a test-preparation booklet. The list is almost endless. However, everything an instructional designer creates has something in common with all other instructional designs: The designer has identified a need for instruction and decided on a method for delivering that instruction. Most instructional designs (the best ones, we would argue, are the ones that follow the precepts of the discipline as it is currently defined by its governing organizations) also have a strategy for evaluating whether the instruction produced and delivered achieved the desired effect as well as how the design might be improved.

Instructional design advocates making use of the available research on how people think, how people learn, the technologies available for communication (information technologies), and methods of analysis. An instructional design is the practical application of this knowledge to create a situation where learning is most likely to effectively occur.

As scholars and practitioners have examined the process of developing, delivering, and evaluating instruction, they have devised a number of models to explain the process; these models are intended to help instructional designers perform their job better. It is important to be aware of the more popular models and to be cognizant of special cases that are currently a topic of discussion within the instructional design community. It is perhaps even more important to understand the big picture of designing instruction for a particular situation in terms that go beyond the application of any one instructional design model or adherence to any one instructional design theory. Hokanson and Gibbons (2014) observe, "Design involves dealing with uncertainties, and designers must not only learn to deal with uncertainty but embrace and use uncertainty as a tool to propel optimal design solutions" (p. 11). To become a well-rounded instructional designer today, one must be able to take a broad view of the ideas and practices that define the field.

Probably the most popular approach to designing instruction is to follow some variation of what is essentially a three-step process:

1. Analyze the situation to determine what instruction is necessary and what steps need to be taken to deliver that instruction.
2. Produce and implement the instructional design.
3. Evaluate the results of implementing the instructional design.

One of the most popular descriptions of this process is **ADDIE**, an acronym that divides the three steps described above into five actions: analyze, design, develop, implement, and evaluate. ADDIE is not really a specific instructional design/development model but an illustration of the conceptual components of many instructional design/development models. See the section "A Special Case: ADDIE" later in this chapter.

Another view of the instructional design process in general is described in David Merrill's "first principles of instruction" (2002, 2013). Merrill (2002, pp. 44–45) suggests there are five basic principles that hold true for the design of any instruction. The first principles of instruction state that learning is promoted when:

- learners are engaged in solving real-world problems;
- existing knowledge is activated as a foundation for new knowledge;
- new knowledge is demonstrated to the learner;
- new knowledge is applied by the learner;
- new knowledge is integrated into the learner's world.

As practitioners of a linking science, instructional designers have become adept at examining and making use of ideas developed by a wide variety of specializations. Students of instructional design learn from other disciplines, sometimes borrowing development models created for activities that are similar to designing instruction (for example, software development, which shares the common purpose of creating something of use and usable to people). There is a tradition within the discipline of instructional design of taking a systematic approach and following accepted protocols for development. However, at this point in time (what many refer to as the postmodern world), the instructional designer may also take an eclectic approach, borrowing ideas and strategies from a variety of unconventional sources.

## Models of Instructional Design/Development

Models by definition are a reflection of reality—temporary stand-ins for something more specific and real. Models are helpful in explaining things that may be difficult to describe. However, it must be remembered that any model is just a shadow or reflection of the *real* thing. A model may describe commonalities among a number of similar items; a model may illustrate a process; a model may be a representation of something:

- A "model home" in a new housing development will not be exactly like every home, but the model serves to give the potential buyer a pretty good idea of what is available for sale.
- Participation in a "model Congress" and "model United Nations" activities give students an opportunity to better understand how the real organizations work, even though they are not the same as participating in the actual UN or congressional meetings.
- Hobbyists build model trains, automobiles, and planes. These models are usually significantly smaller and do not operate in exactly the same way as the original item.

In a professional setting, good models can be helpful tools. They offer guidelines and can ensure a level of quality and uniformity by providing a means of comparison. Well-considered models of instructional design and development can perform this task, helping to explain in general the instructional design process in a way that can be applied to a number of specific situations.

Several well-established and respected models for instructional design/development provide guidelines and procedures that can be applied to a wide variety of specific situations. Using these models to design and develop instruction can help to significantly reduce costs in training and education (Nixon & Lee, 2001).

We have selected—and next describe—two of the most famous models of instructional design/development with which every instructional designer should become familiar: Dick and Carey's systems approach model and Kemp, Morrison, and Ross's plan. These models are intended to guide the instructional designer through the ADDIE process—analysis, design, development, implementation, and evaluation—which is discussed after the two models.

### *The Systems Approach Model for Designing Instruction*

Dick and Carey's systems approach model (see Figure 1.1) is a classic example of performing an instructional design task systematically (Dick & Carey, 1996). At the time it was developed, taking into consideration components of the instructional context—such as the learners and the environment in which the instruction was to be offered—was

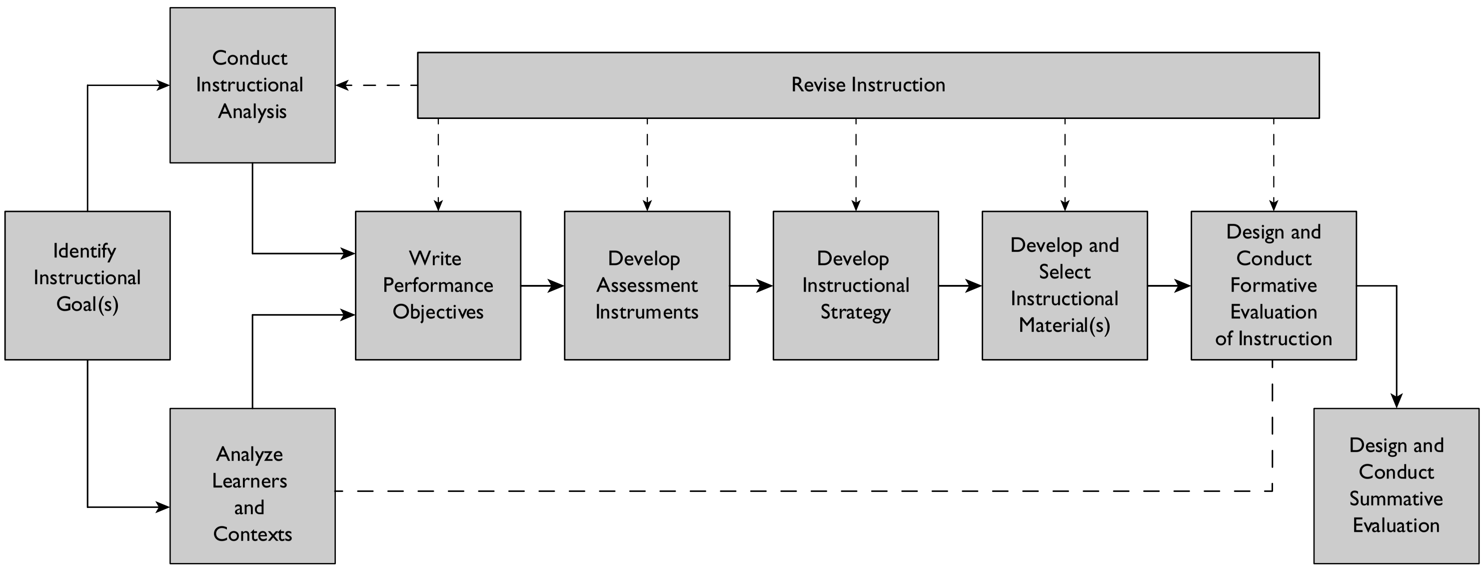


*Figure 1.1* Dick and Carey's instructional systems design model.

Source: Dick, Walter, Carey, Lou, & Carey, James O. *The systematic design of instruction*, 7th edition. © 2009. Printed and electronically reproduced by permission of Pearson Education, Inc., Upper Saddle River, NJ.

a significant departure from the more traditional approach of presenting information through some combination of lecture, textbook reading, review, and testing. With the traditional approach, the burden is placed squarely on the learners to do the best they can with the content, and little thought is given to adjusting or improving the instruction itself. Dick and Carey's model was designed to emphasize the importance of examining and refining the instruction and provides guidance for making improvements (Dick, Carey, & Carey, 2009).

### *Kemp, Morrison, and Ross's Instructional Design Plan*

The Kemp, Morrison, and Ross plan (see Figure 1.2) is expressed as nine elements:

1 Identify instructional problems and specify goals for designing instruction.
2 Examine learner characteristics that will influence your instructional decisions.
3 Identify subject content, and analyze task components related to stated goals and purposes.
4 Specify the instructional objectives.
5 Sequence content within each instructional unit for logical learning.
6 Design instructional strategies so that each learner can master the objectives.
7 Plan the instructional message and develop the instruction.
8 Develop evaluation instruments to assess the objectives.
9 Select resources to support instruction and learning activities.

(Morrison, Ross, & Kemp, 2004, pp. 7–8)

One interesting aspect of this design plan is that it is not illustrated as a specific sequence. According to Morrison et al. (2004), each of the nine elements of development is presented in an oval pattern without lines or arrows pointing the way because each element may be addressed at any time while developing the instruction.

### *Merrill's Pebble-in-the-Pond Model*

Earlier we mentioned David Merrill's first principles of instruction. The model he developed that reflects these principles he named Pebble-in-the-Pond (Merrill, 2013); it articulates six design phases:

1 Design a problem.
2 Design a progression of problems.
3 Design instruction for component skills.
4 Design instructional strategy enhancements.
5 Finalize the instructional design.
6 Design assessment and evaluation.

(Merrill, 2013, p. 249)

A significant difference in Merrill's Pebble-in-the-Pond model from other instructional design models is that it avoids creating objectives before developing instructional content. In most instructional design models, developing detailed instructional objectives is one of the first things accomplished after the initial analysis phase and determining instructional goals. Merrill suggests avoiding writing objectives early in the process because he maintains they tend to change as the instruction is developed. Merrill's model is so named because he contends the first step in the instructional design process is to create

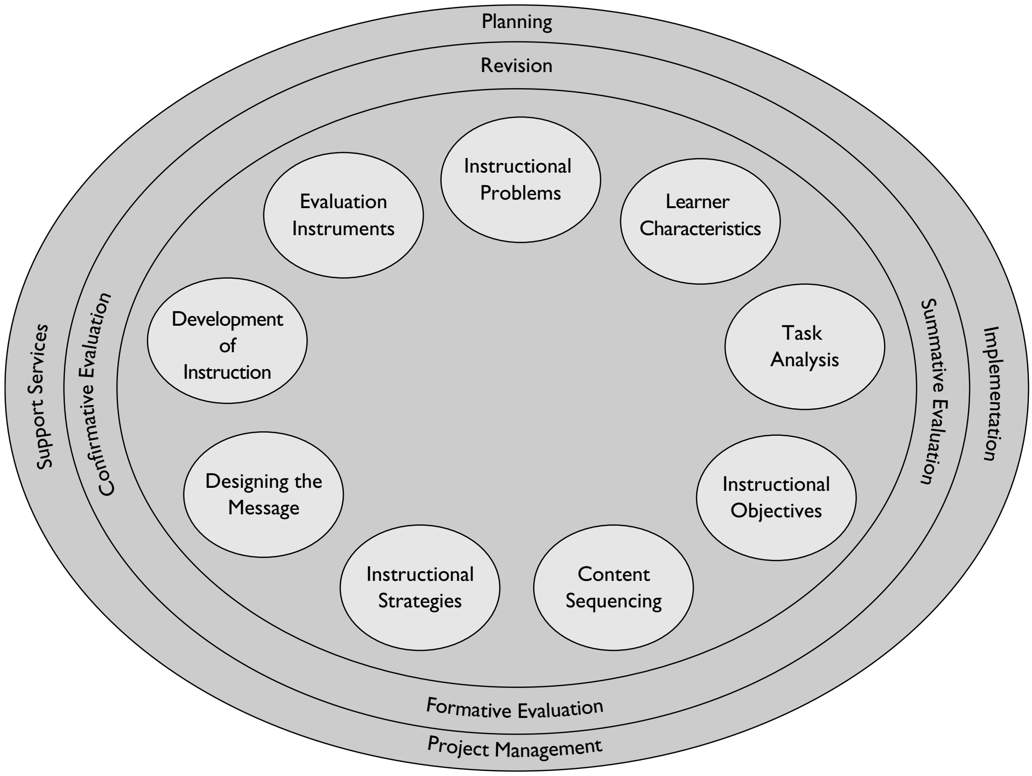


*Figure 1.2* Kemp, Morrison, and Ross's instructional design plan.

Source: Morrison, G. R., Ross, S. M., & Kemp, G. E. "Components of the instructional design plan," p. 12, *Designing effective instruction*, 7th edition. © 2013. Reproduced by permission of John Wiley & Sons, Inc.

or envision, "an instance that represents the whole problem that learners will be able to solve following the instruction" (Merrill, 2013, p. 254). That instance of instruction is the pebble thrown into the pond; the ripples from that pebble are the subsequent steps taken in the design process.

### *Successive Approximation Model*

Michael Allen's Successive Approximation Model (SAM) follows the essential pattern of instructional design models: evaluate → design → develop. The SAM model, however, places greater stress on the iterative nature of each step in the process (Allen, 2012). This is sometimes referred to as an example of agile learning design. The SAM is derived from the agile software development process, which focuses on the development of working product through iterative and incremental development among collaborate teams of specialists (Allen, 2012; Wikipedia, 2014).

### *A Special Case: ADDIE*

One of the most commonly used descriptions of instructional design/development is ADDIE. ADDIE is an acronym for analyze, design, develop, implement, and evaluate

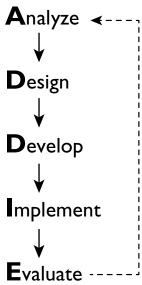


*Figure 1.3* The ADDIE model of instructional design.

(see Figure 1.3). Although many ID practitioners use ADDIE as a prescriptive model for developing instruction, it is actually a means of describing the essential components of *any* instructional design model (Molenda, 2003).

Scholars generally agree that ADDIE is an illustration of the essential steps of the instructional design/development process (Molenda, 2003; Reiser & Dempsey, 2002). ADDIE is particularly useful as a framework for comparing and contrasting more formally and completely developed instructional design/development models.

### *Caveat*

The models described and ADDIE are intended to guide individuals through the process of creating and evaluating instruction. Each model articulates the steps involved in creating an instructional intervention differently, and these are only a few of many instructional design models scholars have created through the years. Often, an instructional designer makes use of a particular model because it is popular within his or her professional setting. Gibbons (2014) points out that simple instructional design models (we might define simple models as those that can be presented easily on a single sheet of paper) were developed out of practical necessity, but in their simplicity these models do not adequately reflect the true nature of a systems approach, which is actually a collection of problem-solving methods and not a single formula. The models we describe briefly in this chapter are not intended as lock-step procedures designing instruction: the creators of each model point out that each step in their model is actually an intricate, iterative process of analysis, design, development, and evaluation. As you begin your study of instructional design, bear in mind that models of instructional design/development are helpful guides to the process, but no single model should be considered a lock-step recipe for creating instruction, nor is any one model the only correct way to design instruction.

## Professional Instructional Design Practice

Deciding how to design and develop instruction often depends on the organizational setting in which the instructional design professional finds him- or herself. Organizations that have established traditions of delivering instruction may demand that certain forms be followed. For example, universities in North America and Europe traditionally require that, for each course offered, a syllabus be created beforehand and students receive evaluation in the form of letter grades (an evaluation strategy developed at Cambridge University in the early 1800s). University courses traditionally require weekly 3-hour meetings (or semiweekly 1.5-hour meetings). These requirements necessarily affect the way college professors design their instruction.

K-12 environments are under different but similar constraints. Designers who create instruction for K-12 school settings (this would include teachers, textbook writers, educational software manufactures, etc.) must work within the constraints of a system that has a specific timeframe (in the United States, typically 182 days of school, with approximately 7 hours of instruction each day beginning with the first grade), assigned curriculum (established by state and local authorities), and evaluation procedures that include the awarding of letter grades and promotion to grade levels.

Nonacademic organizations have their own traditions and requirements for instructional design. For example, the US military has a tradition of using specific theories and development models to guide instructional design activity. During the 20th century, the US military offered instructional designers numerous opportunities to contribute to the knowledge base of the discipline: Military actions that required the massing of troops from a civilian population also required that those troops receive training for their new roles. In peacetime, military personnel must receive training on a variety of highly technical, demanding, and dangerous tasks for which public school and college has not prepared them. These models continue to be used as protocols, allowing designers to develop instruction efficiently and (it is hoped) effectively.

Today, most instructional design teams consist of a variety of specialists including artists, writers, subject-matter experts, programmers, project managers, assessment specialists, and evaluators (Gibbons, 2014; Green & Brown, 2002). At the same time, many teachers, human-resource specialists and media producers design and produce instruction on their own or in very small groups. The approach you take to designing instruction will of course depend heavily on your professional setting and available resources.

### *Traditional Approaches (Analyze, Develop, Evaluate)*

What are generally considered traditional approaches to instructional design are in fact based on relatively recent developments in the theory of how people think about the way the world works. In the 1950s, the basic concepts and principles of a general theory of systems were established by scholars (notably Ashby, Bertalanffy, Boulding, Fagen, Gerard, Rappaport, and Weinner), who were, at the time, pioneers of a new method of thinking about how people and things operate (Banathy, 1996; Banathy & Jenlink, 2004). One critical argument was Bertalanffy's observation that modern science was becoming increasingly specialized and that people therefore perceived science not as an integrated realm but rather as a series of small specializations that operated using their own premises, techniques, and structures. The goal of general systems theory (GST) is to explain the common elements of the theoretical constructions of the various scientific disciplines.

General systems theory is similar to the search for a unified field theory in physics. Currently in the scientific discipline of physics, there are theories that seem to successfully explain how the universe works at the submicroscopic level (electromagnetic forces), and there are theories that seem to successfully explain how the universe works on a larger level (gravitational forces). However, the two sets of theories cannot be put together into one logical theory that explains how the universe works on every level. The unified field theory is what physicists hope will explain the fundamental interactions of the physical universe, both electromagnetic and gravitational. Work on the GST is in some ways the social scientists' version of a unified field theory; the GST is what they hope will explain—in general—how systems work, regardless of the specific setting.

The quest for a unified field theory can also be used as an example of how little is known about the world. In physics, various theories are used for practical purposes to explain and predict phenomena, but physicists are still working to discover "the truth" about how the physical world works. Like physicists, educators use a variety of theories to explain and predict how learning and instruction work. However, no educational theory is universally accepted, and no one knows "the absolute truth" about instruction and learning environments.

The academic community was deeply influenced by the ideas put forth by systems theory. That influence continues to this day; most people take for granted the concept that much of what occurs in the world is influenced by—and in turn influences—actions and events that may not seem at first related to each other. One more modern and extreme example is chaos theory, which was popularized by the idea that a butterfly's wings beating in the Amazon has an effect on the amount of rainfall Newfoundland receives in a year (Gleick, 1987).

In examining a systems approach to designing instruction, Hoban wrote:

> In any system, everything is related to everything else, sooner or later and in one way or another. This means that every essential element, factor, or component, and some seemingly inconsequential ones, can seriously affect the final product, outcome, or output of the system. What media people do or don't do not only affects other people in the system but the quality of the output of the entire system. This follows from general systems theory.
>
> (1977, p. 71)

Systems theory caused educators to examine how the various factors that influence learning interact to create a complete instructional experience. How the learner thinks, what the learner knows prior to the instructional event, what motivates the learner, how the teacher teaches, what the consequences of evaluation are, and many other factors became objects of consideration. This once-innovative approach to instruction has become the modern standard.

### *Nontraditional Approaches*

A systems approach to instructional design is the modern approach. The word "modern" in this case refers to the period in history called the "modern age" (the age of approaching problems logically and scientifically; solving those problems systematically using new and innovative technologies). One school of thought argues that the current era is a postmodern age (Hlynka, 1995, 2004). It is *post*modern because scholars can identify and describe the reasons for "modern" approaches. Whether experts agree or disagree with the approaches and the reasoning behind them, once they are identified and described, they are relegated to a specific time period; the current generation is outside of that time period—hence, the term "postmodern."

The discipline of instructional design blossomed at a time when systems thinking was a dominating force in the scientific and academic community. For this reason, it is often referred to as "instructional systems design" or "instructional systems technology." Instructional systems design is used primarily to teach adult learners and is based on a mastery approach (a student may move on to the next task only after he or she has mastered the previous one). This approach is **behavioristic** in that it works only for instruction that is immediately measurable (the ability to perform a task) and requires that the instruction follow from a specific behavioral objective (for example: "At the end of the instruction, the student will be able to take apart and put together a carburetor").

> The ISD [instructional systems design] model begins at the curriculum level with analysis of content, definition of overall objectives, delineation of sequences and subsequences of the curriculum. It proceeds with the selection of instructional methods and media, designing individual lessons to enhance learner mastery of the objectives, developing delivery systems for the individual lessons, and ends with evaluation of the lessons and the entire instructional system. Evaluation in ISD emphasizes measurement of observable target behaviors.
>
> (Alessi and Trollip, 2001, p. 18)

Instructional systems design has been criticized as generating models that are too complex to use effectively and focusing too much on strictly observable (behavioral) outcomes without addressing the more subtle aspects of learning that include reflection, retention, and motivation (Alessi & Trollip, 2001). Having shifted from placing all responsibility on the learner without regard for the design of the instruction, teaching had shifted to a point where the learner was becoming an overlooked portion of the instructional design process.

In the 1980s and 1990s, instructional design theorists began to develop models that include approaches that diverge from the strictly behavioral. Cognitive and constructive approaches became topics of discussion and research (Alessi & Trollip, 2001; Reigeluth, 1999).

## Professionals in Practice

Where do the roots of my ID philosophy come? The first one comes from my undergraduate study of mathematics. I believe that many concepts of mathematics are helpful for instructional technologists. I am particularly under the influence of the concepts of chaos theory while working on any ID project. Unfortunately, I am not the inventor of this idea. This connection between chaos theory and ID was already realized by other researchers in our field (e.g., Jonassen, 1990; You, 1993). Why is chaos theory important for me, and why is it a part of my ID approach? Here is a quick summary.

Several researchers agree that the traditional systems approach to problem-solving has a reductionist nature, and it tends to solve a problem by fragmentation—one stage at a time (Finegan, 1994; Jonassen, 1990; You, 1993). This approach may work for some small-scale and well-defined situations. However, the systems associated with human activity are complex and not well defined. According to Jonassen (1990), "simple systems behave in simple ways, and complex systems behave in complex and less predictive ways. The behavior of a system cannot be examined accurately by analyzing its components" (p. 34). As an alternative to a linear, reductionist, and deterministic approach, chaos or the dynamical systems approach is proposed. In a complex system, "the components are related and interlock with one another such that a change in one component invariably affects another part of the system, or eventually even the entire system" (Murnare, cited in Chieuw, 1991, p. 25). Gordon and Greenspan explain chaos as the study of disorder, and it appears in nonlinear systems (as cited in King, 1991). Because Chaos deals with nonlinear and disorderly systems, many disciplines—including technological, social, and economic—are appropriate for applying its principles. As stated by Highsmith (2000), "from physics to

*(continued)*

*(continued)*

biology to chemistry to evolution, complex adaptive systems theory began to help explain occurrences in the real world that the linear approximations of the old science could not" (p. 10). According to King (1991), for many different disciplines, chaos gives new data, suggests innovative approaches to old ideas, and reaffirms certain approaches. Before proceeding further, in order not to cause a misunderstanding, it is better to state that nonlinear systems are not completely disorderly systems. As stated by Chieuw (1991), such systems have an interconnected nature, and a subtle order is always present.

Actually, instructional systems design (ISD) is inherently a complex process, which some instructional designers have already noted. For example, Appelman (2000) states that in real life, when experts implement the ISD process, they realize that the linear approach does not work. He says, "It appears to be almost a random pattern of attention being focused on different steps of the process out of order" (p. 137). So, it is not wrong to say that ISD is a chaos-based system.

*Kursat Cagiltay*
*Professor at Turkey's Middle East Technical University in Ankara*
*Department of Computer Education and Instructional Technology*

### *Eclecticism and Postmodern Approaches*

We have offered a general definition for the term "postmodern": after the historical period referred to as "modern." However, the guiding principles of postmodern thought are far more difficult to define. **Postmodernism** is concurrently an historical epoch, an intellectual movement, and a general social condition (Hlynka, 2004; Solomon, 2000).

A postmodern approach to instructional design recognizes that the instructional designer must take four societal factors into account:

1. Society is past the point where there are a limited number of authorities available to a classroom student. The modern classroom had two authoritative sources: the teacher and the textbook. This situation no longer exists because students have access to many other sources, including the internet, television, and, in some cases, friends and family who are more educated than the teacher is (Hlynka, 1995).
2. No longer can there be an agreed-upon, single type of well-educated individual. Determining a curriculum and including all important artistic and scientific works that would be appropriate for all individuals is impossible.
3. The currently popular cognitive paradigm—constructivism—does not recognize or advocate a traditional, linear educational sequence. With information available from a variety of sources outside the classroom, learners will inevitably deviate from a linear instructional model by observing and reacting to other examples, non-examples, and divergent examples of the concepts they study in school.
4. No single, objective truth exists. Truth is a construct that is based on an individual's personal interpretation or on the consensus of a group of people for their purposes. The truth—also known as "the right answer"—may change depending on the context and the individuals involved.

Postmodernism may also be referred to as "postpositivism" because the "modern" approach was **positivistic**. In a positivistic worldview, any problem has only one correct answer; postpositivism suggests that any one problem may have a number of different correct answers depending on the worldview of the person attempting to derive the answer.

According to Solomon (2000, p. 423), a postmodern philosophy of instructional design has the following tenets at its core:

- The philosophical core of postmodern instructional technology is a belief in pluralism, which can be described as respect for difference and resistance to single explanations.
- Knowledge, truth, and reality are constructed by people and groups of people.
- Criticism is an appropriate method for inquiry in instructional technology.
- Systems are interpreted as highly complex entities with adaptive qualities.

According to the postmodern approach, completely isolating the learner or the instructional event may not be possible. Furthermore, isolating the process of instructional development to apply a traditional instructional design/development model in the way it was originally intended may not be possible.

Postmodernism in instructional design does not necessarily reject the more traditional systems approach. To some extent, postmodern thought suggests only that the system may be far more complex than anyone had originally thought.

Postmodernism coincides with the proliferation of computing tools that allow individuals a greater degree of freedom in creating sophisticated printed work and interactive software. Before the proliferation of desktop publishing and multimedia authoring programs, creating high-quality instructional media was the province of specialists. The ubiquity and popularity of programs such as Microsoft's PowerPoint attest to the fact that everyone now considers him- or herself competent to create and deliver media that are adequate for professional presentation and distribution. Prior to the mid-1980s, an individual had to rely on a trained specialist with access to esoteric tools to create materials such as handouts, brochures, slide presentations, videos, and interactive software.

Instructional designers became aware of the limitations of a systems approach around the same time they came into control of tools that would allow them to design and create instructional media without having to entirely rely on those who specialized in the development and production portion of the instructional design/development process. Access to these new computing tools meant the process of creating mockups, prototypes, and finished products became less costly and time-consuming. One concern about all this newfound flexibility in creating instructional media is that it can lead to slipshod development.

> Experienced designers and typographers were appalled that so many people (including some of their longtime clients) could be hoodwinked into thinking that the results of "dumping text" into page layout templates and "copying and pasting" clip-art were synonymous with expert design. Although professionals tacitly knew that quality design and illustration were not just a "click" away, very few of them could characterize their expertise in ways that nondesigners could appreciate.
>
> (Schriver, 1997, p. 43)

This awareness that a person might not have to follow a systems model to the letter and that an individual had the power to create the necessary media with his or her laptop computer leads instructional designers to experiment more with nontraditional approaches.

It can easily lead them to take an eclectic approach, picking and choosing the better aspects of any number of design procedures and recommended practices.

An eclectic approach allows the designer to choose specific elements from a variety of sources. This approach can be viewed both as "taking the best there is to offer" and "taking things out of context." It is easy to see why this approach might make scholars of instructional design uncomfortable; if not carefully considered, articulated, and evaluated, the linking science that so many worked to create might be seen as changing to a less rigorous, less scientifically sound activity.

However, just as some well-established, dedicated educators were dismayed at the advent of a science of instructional design at the end of the 19th century, some well-established, dedicated instructional designers are dismayed at the advent of a change in the science of instructional design at the beginning of the 21st century. A heightened awareness of the greater complexity of systems and the new, increasingly ubiquitous, computer-based media production tools have created a situation in which instructional designers must adapt their views and practices.

### *Example: Rapid Prototyping*

**Rapid prototyping** is a different approach to the design and development of instruction. It represents a relatively recent paradigm shift in instructional design because it does not strictly follow the traditional systems process of design and development. Part of the conversation among instructional designers for more than a decade, rapid prototyping is a development approach used in a variety of professions and has been found particularly useful in engineering-oriented activities (e.g., automobiles are designed by creating a series of testable prototypes). The essential idea behind rapid prototyping is to arrive at a final product through the creation of a number of prototypes. Each prototype is evaluated by some combination of experts and end users; each successive prototype is more like the final product; that is, the fidelity of the prototypes increases with each new one until a working product is achieved.

For example, a typical set of prototypes developed in the process of creating a working piece of instructional software might include:

- rough pencil sketches;
- refined pencil sketches;
- computer-generated printouts (a paper mockup);
- a computer-based prototype with little or no interactive programming;
- a computer-based prototype programmed with appropriate interactions and navigation;
- the final product.

A rapid prototyping approach requires that the design environment allow for the relatively quick and easy creation of instructional materials (Tripp & Bichelmeyer, 1990). The current availability of computing tools that facilitate the creation of instructional media (including word-processing, image-editing, and software-authoring software) greatly increases the attractiveness of the rapid prototyping approach.

As Rathbun, Saito, and Goodrum (1997) pointed out, "the intermediate prototypes become an important means of getting feedback; the design and development process become intertwined" (p. 291). This method is different from traditional instructional design approaches in which the design process and the development process are separate.

In traditional instructional design models, once the design has been prepared, no critical feedback about the design is offered during the development process. When instructional design is accomplished by a large group of specialists, separating the design and development has a certain utility: "Make the product according to the specifications that an expert has provided; send the finished product to experts for evaluation." An underlying assumption of this approach is that an expert in a specific area oversees each stage of the instructional design process. The traditional process focuses on creating an effective end product without much regard for the efficiency of the process, which is time-consuming and costly (Nixon & Lee, 2001; Tripp & Bichelmeyer, 1990).

Traditional theatrical production may be considered a form of rapid prototyping for artistic purposes. A time-honored approach to preparing a theatrical presentation is the process of rehearsal and criticism. The play begins as an idea that a writer puts down on paper. The successive prototypes include: a read-through, where the actors speak their lines to each other without any staging or costumes or lighting; a walk-through, a performance with actors in their street clothes; a dress rehearsal, with sets, costumes, and lighting (but no audience); and a preview, with sets, costumes, lighting, and an invited audience that is aware the production is a work in progress. At each point in this process, the actors and designers receive feedback from the director as well as from the other actors and designers (and, in the last stage, the preview audience). This incremental feedback is used to improve and refine each new performance until opening night, when the play is considered a completed artwork. Even after the work is considered complete, the director, cast, and crew continue to monitor performances to evaluate their success and determine what (minor) changes might be necessary.

Rapid prototyping may be seen as an example of a new way of viewing the instructional design process. The traditional approach to instructional design is based on the underlying assumption of the objectivity of science and the scientific method. With rapid prototyping, the scientific method is not rejected, but a more constructive (as opposed to objective) approach to the problem can be taken by incorporating more opportunities for everyone involved in an instructional design project (the clients, the designers, the producers, the learners) to participate in evaluation, problem solving, and revision. Rapid prototyping is a popular way of thinking about and approaching instructional design problems, but it is not a perfect solution. We end this chapter with an admonition from Tripp and Bichelmeyer:

> The main disadvantage of prototyping can be summed up in one complaint that is easy to imagine: it has a tendency to encourage informal design methods which may introduce more problems than they eliminate . . . Prototyping can lead to a design-by-repair philosophy, which is only an excuse for lack of discipline . . . Prototyping may lead to premature commitment to a design if it is not remembered that a design is only a hypothesis.
>
> (1990, p. 42)

This warning should serve as a reminder that a "Let's try it and see what happens" approach is no substitute for careful planning and evaluation.

## Summary

Instructional design is the linking science that applies logic and scientific methods to the problems involved in designing and developing instruction. Instructional design developed from the discipline of educational psychology that came into being at the turn of the 20th century. Instructional design became particularly popular with the articulation and acceptance of a general systems theory around the 1950s. One problem instructional design faces is its long association with strictly behavioristic approaches to teaching. Instructional design scholars have produced models of instructional design/development that describe the process of analysis, design, development, implementation, and evaluation (ADDIE).

Recent approaches to the instructional design process include breaking from the tradition of systems models in favor of more eclectic approaches that combine the five processes of instructional design instead of formally separating them. Two critical factors that foster this type of approach are a postmodern approach to solving a problem and new and relatively easy-to-use, computer-based multimedia production tools. A particularly popular postmodern approach to instructional design is rapid prototyping, which suggests that the final product should be taken through a series of mockups that can be evaluated and refined, with each new mockup getting closer to how the final product will look and operate. A potential pitfall of rapid prototyping is an informality that may produce an undisciplined approach to the instructional design problem. For any instructional design problem, careful planning and evaluation are always recommended.

## Connecting Process to Practice Activities

1 After reading the chapter, how has your thinking about education and designing instruction changed?
2 Write a brief letter to a friend or family member who is not a professional educator or instructional designer, explaining what you are currently studying. In the simplest possible terms, describe instructional design.
3 As a novice instructional designer, which aspects of developing instruction do you consider to be inherently artistic? Which aspects of developing instruction do you consider inherently scientific?
4 Which model of instructional design/development would you most likely follow? Why do you suppose that model is particularly appealing to you?
5 Do you consider your view of the world to be positivistic or postpositivistic? How might your feelings about positivism affect your approach to instructional design?
6 Would you consider rapid prototyping to be an eclectic approach to instructional design? Why or why not?
7 Consider your own experiences as a teacher or instructional designer. What model can you develop that illustrates your own instructional design process?
8 Create a timeline of key events in the history of instructional design from the late 1800s to the present day.
9 If you were to create a reality television show that featured instructional designers similar to shows that feature chefs and fashion designers, what challenges would you set for the contestants? How would the contestants' projects be evaluated?

## Recommended Reading


Gagne, R. M. (1985). *The conditions of learning and theory of instruction*. New York: Holt, Rinehart and Winston.

Kearsley, G. (2009). *Theory into practice (TIP)*. Retrieved from http://tip.psychology.org.

Reigeluth, C. M. (1983). *Instructional design theories and models: An overview of their current status*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Reigeluth, C. M. (1999). *Instructional-design theories and models: A new paradigm of instructional theory, Vol. II*. Mahwah, NJ: Lawrence Erlbaum Associates.

## References

Alessi, S. M., & Trollip, S. R. (2001). *Multimedia for learning: Methods and development* (3rd ed.). Boston: Allyn & Bacon.

Allen, M., with Sites, R. (2012). *Leaving ADDIE for SAM: An agile model for developing the best learning experiences*. Alexandria, VA: American Society for Training and Development.

Appelman, R. (2000). An iterative development model: A genesis from pedagogical needs. *International Journal of Engineering Education and Lifelong Learning, 10*(1–4), 136–141.

Banathy, B. (1996). Systems inquiry and its application in education. In D. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 74–92). New York: Macmillan.

Banathy, B. H., & Jenlink, P. M. (2004). Systems inquiry and its application in education. In D. Jonassen (Ed.), *Handbook of research for educational communications and technology* (2nd ed.) (pp. 37–57). Mahwah, NJ: Lawrence Erlbaum Associates.

Berliner, D. (1993). The 100-year journey of educational psychology, from interest, to disdain, to respect for practice. In T. K. Fagen & G. R. VandenBos (Eds.), *Exploring applied psychology origins and critical analysis: Master lectures in psychology*. Washington, DC: American Psychological Association.

Chieuw, J. (1991). An alternative approach to educational planning based on a conceptual framework of the educational system as dynamic: A theoretical study. Unpublished doctoral dissertation, Florida State University, Tallahassee.

Dewey, J. (1900). Psychology and social practice. *The Psychological Review, 7*, 105–124.

Dick, W., & Carey, L. (1996). The systematic design of instruction. In D. P. Ely & T. Plomp (Eds.), *Classic writings on instructional technology, Vol. II*. Englewood, CO: Libraries Unlimited.

Dick, W., Carey, L., & Carey, J. O. (2009). *The systematic design of instruction* (7th ed.). Columbus, OH: Allyn & Bacon.

Finegan, A. (1994). Soft systems methodology: An alternative approach to knowledge elicitation in complex and poorly defined systems. *Complexity International, 1*, 232–241.

Gibbons, A. (2014). Eight views of instructional design and what they should mean to instructional designers. In B. Hokanson & A. Gibbons (Eds.), *Design in educational technology: Design thinking, design process, and the design studio*. Cham, Switzerland: Springer International Publishing.

Gleick, J. (1987). *Chaos: Making a new science*. New York: Viking.

Green, T., & Brown, A. (2002). *Multimedia projects in the classroom: A guide to development and evaluation*. Thousand Oaks, CA: Corwin Press.

Heinich, R., Molenda, M., Russell, J. D., & Smaldino, S. E. (1996). *Instructional media and technologies for learning*. Englewood Cliffs, NJ: Merrill Prentice Hall.

Highsmith, J. A. (2000). *Adaptive software development: A collaborative approach to managing complex systems*. New York: Dorset House Publishing.

Hlynka, D. (1995). Six postmodernisms in search of an author. In G. J. Anglin (Ed.), *Instructional technology: Past, present, and future* (pp. 113–118). Englewood, CO: Libraries Unlimited.

Hlynka, D. (2004). Postmodernism in educational technology: Update 1996–present. In D. Jonassen (Ed.), *Handbook of research for educational communications and technology* (2nd ed.) (pp. 243–246). Mahwah, NJ: Lawrence Erlbaum Associates.

Hoban, C. F. Jr. (1977). A systems approach to audiovisual communications. In L. W. Cochran (Ed.), *Okoboji: A 20 year review of leadership 1955–1974* (pp. 67–72). Dubuque, IA: Kendal/Hunt. Reprinted in D. P. Ely & T. Plomp (Eds.), *Classic writings on instructional technology, Vol. I*. Englewood, CO: Libraries Unlimited.

Hokanson, B., & Gibbons, A. (Eds). (2014). *Design in educational technology: Design thinking, design process, and the design studio*. Cham, Switzerland: Springer International Publishing.

Jonassen, D. H. (1990). Thinking technology: Chaos in instructional design. *Educational Technology, 30*(2), 32–34.

King, J. W. (1991). *Chaos, communication and educational technology*. Paper presented at the annual meeting of AECT, Orlando, Florida.

Merrill, M. D. (2002). First principles of instruction. *Educational Technology Research and Development, 50*(3), 43–59.

Merrill, M. D. (2013). *First principles of instruction: Identifying and designing effective, efficient, and engaging instruction*. San Francisco: Pfeiffer.

Molenda, M. (2003). In search of the elusive ADDIE model. *Performance Improvement, 42*(5), 34–35.

Morrison, G. R., Ross, S. M., & Kemp, J. E. (2004). *Designing effective instruction* (4th ed.). New York: John Wiley & Sons.

Morrison, G. R., Ross, S. M., & Kemp, J. E. (2013). *Designing effective instruction* (7th ed.). New York: John Wiley & Sons.

Nixon, E. K., & Lee, D. (2001). Rapid prototyping in the instructional design process. *Performance Improvement Quarterly, 14*(3), 95–116.

Rathbun, G. A., Saito, R. S., & Goodrum, D. A. (1997). Reconceiving ISD: Three perspectives on rapid prototyping as a paradigm shift. In *Proceedings of Selected Research and Development Presentations at the 1997 National Convention of the Association for Educational Communications and Technology* (pp. 291–296). Washington, DC: AECT.

Reigeluth, C. M. (Ed.). (1983). *Instructional design theories and models: An overview of their current status*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Reigeluth, C. M. (Ed.). (1999). *Instructional-design theories and models: A new paradigm of instructional theory, Vol. II*. Mahwah, NJ: Lawrence Erlbaum Associates.

Reiser, R., & Dempsey, J. (2002) *Trends and issues in instructional design and technology*. Upper Saddle River, NJ: Merrill Prentice Hall.

Saettler, P. (1990). *The evolution of American educational technology*. Englewood, CO: Libraries Unlimited.

Schriver, K. A. (1997). *Dynamics in document design*. New York: John Wiley & Sons.

Smith, P. L., & Ragan, T. J. (2005). *Instructional design* (3rd ed.). New York: John Wiley & Sons.

Snellbecker, G. (1974). *Learning theory, instructional theory, and psychoeducational design*. New York: McGraw-Hill.

Solomon, D. L. (2000). Toward a post-modern agenda in instructional technology. In *Annual Proceedings of Selected Research and Development Papers Presented at the National Convention of the Association for Educational Communications and Technology* (pp. 415–428). Bloomington, IN: AECT.

Tripp, S. D., & Bichelmeyer, B. (1990). Rapid prototyping: An alternative instructional design strategy. *Educational Technology Research and Development, 38*(1), 31–44.

University of Michigan. (2003). *Definitions of instructional design*. Adapted from "Training and instructional design," Applied Research Laboratory, Penn State University (1996). Ann Arbor: The University of Michigan. Retrieved from www.umich.edu/~ed626/define.html.

Wikipedia. (2014). *Agile software development*. Retrieved from http://en.wikipedia.org/wiki/Agile_software_development.

You, Y. (1993). What can we learn from chaos theory? An alternative approach to instructional systems design. *Educational Technology Research and Development, 41*(3), 17–32.